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ABSTRACT

This handbook, which is intended for further education (FE) practitioners and decision makers in Britain looking to develop high-quality information and learning technology (ILT), presents practical guidelines for conducting the self-assessment, analysis, prioritizing, and action planning required to make strategic decisions about ILT at their FE college. Presented first are a preface that explains the handbook's purpose within the context of the Further Education Development Agency's Quality in Information and Learning Technology (QUILT) initiative and an overview of the handbook. The following topics are discussed in the handbook's seven sections: external change factors and learning from history (development of information technology and information in the context of ILT); learning and the management of change (organizational transformation, learning organizations, and quality and planning); organizational management of ILT (application and infrastructure, future-proofing, curriculum management, and information management); learning environments; individual learning; learning content; and setting quality standards for ILT (key points and quality indicators). The handbook contains 19 references. (MN)

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Information and learning technology: a development handbook

Terry Cowham

Volume 1 Number 15

QUILT

FE MATTERS

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Information and learning technology: a development handbook

Terry Cowham

FE MATTERS

FEDA paper

About the author

After graduating in geography in 1976, Terry Cowham worked in computing in the steel industry for five years before moving into further education. In 1976, Terry was responsible for developing one of the first microcomputer systems to be used in further education. He became Principal Lecturer responsible for information technology development at Blackpool and Fylde College, and was active in providing consultancy services both home and overseas. In 1984, he moved into senior management at North Manchester College, and was promoted to Vice Principal in 1986 and to managing a series of college amalgamations. He tutors for the Open University in Education Management and has a number of publications to his name. Terry has just retired from his post of Senior Vice Principal at Manchester College of Arts and Technology to focus on his research and development interests in work-based learning, the management of change, quality and information and learning technology.

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Preface

FEDA's main priorities include implementing strategies to:

- support the development of quality in the further education curriculum, which includes working with and for colleges on self-assessment
- help ensure effective and relevant development of information and learning technology (ILT) in the sector

These two priorities combined create FEDA's QUILT initiative: Quality in Information and Learning Technology.

The QUILT programme is not just about staff development; it will help colleges to develop a corporate response to ILT which encompasses staff, curriculum and resources. QUILT has been designed to allow colleges to take strategic decisions about ILT and then to select those aspects of the programme relevant to their strategy. These include events, publications, multimedia resources, flexible learning resources, a consultancy service and development activities.

FEDA intends this handbook to be a useful tool within the QUILT programme for carrying out self-assessment and analysis, and for setting priorities and devising an action plan for change. It is informed by current thinking on ILT: its author, Terry Cowham, has experience of successful application of ILT in further education colleges. His grasp of fundamental ideas and first-hand experience make this handbook a stimulating and practical guide for further education staff looking to develop quality in ILT.

Kevin Donovan
Head of Technology and the Management of Learning, FEDA

Applying ILT effectively: an overview of this handbook

All of the developments in information and learning technology (ILT) have created many implications for further education (FE) colleges. To respond effectively to these developments FE providers need to ensure that comprehensive strategies are firmly in place. FEDA summarised some of these strategic implications in an article in the July 1996 issue of its newsletter *inform*. This handbook develops these issues further to provide a development guide. It aims to provide practical advice and recommendations to FE practitioners and decision-makers, while complementing current initiatives, including FEDA's response to the report of the FEFC's Learning and Technology Committee. It includes a summary of the significant work undertaken in the field.

Learning from history

The first section of this handbook analyses the development of information technology (IT) and its socio-economic consequences to provide a prognosis for further education. This analysis stresses the consequences of technological convergence and the need for institutions to have strategies for ensuring a profitable return on investment (referred to as a 'future-proofing' approach) whether it be in staff and applications development or in resources. Particular reference is made to work and findings of the MIT 90s Research Group and its model for business transformation, which has been applied to education by the National Council for Educational Technology (NCET) and also used to propose a learning environment architecture for higher education.

Managing change

If educational organisations are to apply ILT effectively and cope with continuing and increasing turbulence in their environments they need to 'practise what they preach' and become learning organisations. The issues behind achieving this are examined in the next section of the handbook. This leads into an exploration of the fundamentals of learning and how ILT can be applied to provide effective learning environments. Providing flexible access to high quality learning materials ('electronic publishing') and improving systems for tutoring, assessment, the recording of achievement and portfolio management are proposed as the ways to achieve this.

Working with the models

Models are provided throughout as development tools. A quality cycle is proposed as essential for underpinning learning and the effective application of ILT. How to harmonise and harness quality systems and processes in planning is explored. Ways to provide an efficient infrastructure for stimulating efficient applications of ILT are then examined. Underpinning each stage is the importance of defining and applying quality standards. These models aim to offer new insights and approaches to ILT development.

Going for quality

Each section of this handbook is concluded by a summary of three key points. For each key point a quality or strategic indicator is proposed, which can be used to derive quality standards. Finally, the quality indicators are used to propose a set of categorised quality standards for ILT, which will support institutional planning and development.

Using this handbook

The approach you take to using this handbook will to some extent be dependent upon your preferred learning style, as defined later on in this handbook in Section 5. The 'pragmatists' and 'activists' may want to begin at the end of this handbook at Section 7, which offers a checklist of quality standards. These cover all aspects of developing an ILT strategy, discussed in this guide. They can then work backwards into the text, which takes each aspect in turn

and looks in more detail at the theory and issues underpinning the key points and quality indicators. The 'theorists', from the learning styles model, may instead prefer to start at the beginning. 'Reflectors' may want to start at Section 2 where the transformation model is defined, and the means by which your college can become a 'learning organisation' is proposed. They can then move around the handbook in the order that interests them most.

The summaries, one at the end of each section, are designed to be used as assessment tools to audit your college's current position and to identify an action plan for achieving the necessary progress.

Terry Cowham

1. External change factors: learning from history

Development of IT

Information technology has a dramatic and short history. The digital computer, which is at the heart of the technology, is only 50 years old and has changed considerably during that time. Originally constructed from valves, the transistor led to a second generation and then early integrated circuits introduced a third generation of general purpose 'mainframe' digital computers. However, these phases of development can be considered to be BC ('Before the Chip'). A new age began with the development of microprocessors in the early to mid 1970s. With the advent of the microprocessor, technological convergence began to accelerate and computing capability was incorporated in a range of industrial, commercial and consumer goods.

This is just the history of hardware development. From the outset the key feature of the computer has been its general purpose applicability to all forms of information processing by means of programs of coded instructions known as software.

Without software the computer is useless. It allows the computer to be used for calculation, information storage and retrieval, control and communication. Developments in software have occurred alongside developments in hardware. The continuous trend has been towards providing more powerful features, known as 'increasing functionality', along with enhancing ease of use. The current applications standard for ease of use is the point and click WIMP (Windows-Icon-Mouse-Pointer) environment provided by Microsoft Windows, for example.

The Internet, regarded as a recent phenomenon, began its development more than 25 years ago. However, its widespread application has only taken off in the 1990s with the development of the World Wide Web (WWW), a software development which provides the point and click facilities for accessing information from anywhere on the world wide network of computers that make up the Internet. Currently, it is estimated that the number of documents available on the 'net' doubles every 55 days and these are stored at more than 17 million unique addresses around the world (NCET, 1997).

During the last 50 years, it is significant that the emphasis in computer applications has changed from computation to communication.

It was only in the 1980s that microcomputers began to infiltrate colleges widely. In my 1982 review of 'Information Technology in the College' I pointed out that it was:

> *"imperative for institutions to develop coherent attitudes and policies to the acquisition, application and organisation of computing, communications and other ancillary equipment associated with information technology".*

This was part of a plea for colleges to attempt to adopt holistic approaches to 'future-proofing', that is to anticipate IT developments to ensure profitable return on technology investments. It had become clear that the major cost in the application of IT was neither hardware nor software, but the staff time and skills needed both to learn, and to develop and service applications. The benefits of subscribing to 'industry standards' in terms of hardware and software applications were becoming clear, as was the need for high quality learning materials or 'courseware'.

The widespread infiltration of home computing, along with media and communications developments such as satellite and cable communication, in harmony with organisational change continues to raise society's awareness of the rate and level of technological development. Recently, public attention to these developments has been further stimulated by the hype surrounding the 'information superhighway'. Based on the concept of delivering information using broadband communication channels, the 'superhighway' presents opportunities and threats to the future application of ILT by colleges.

Significant features that can be identified in the development of IT are the:

- pace of technological change — the cost of computing power drops by roughly 30 per cent every year, and microchips double in performance power every 18 months
- remorseless convergence of computing and communications technology — a home video camera now:

  "contains more processing power than an old IBM 360, the wonder machine that gave birth to the mainframe computer age" (Huey, 1994)

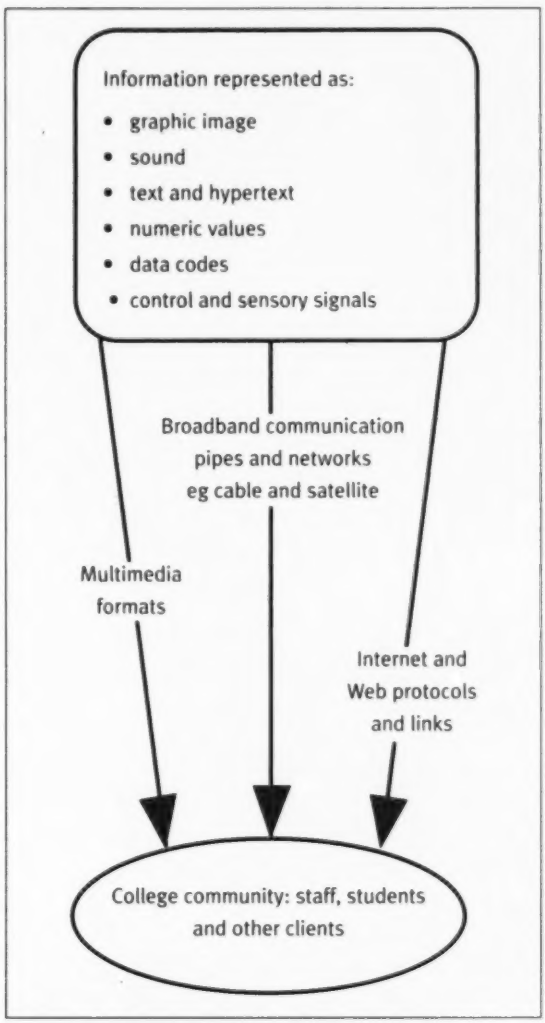
Information represented as:
• graphic image
• sound
• text and hypertext
• numeric values
• data codes
• control and sensory signals
Broadband communication pipes and networks eg cable and satellite
Multimedia formats
Internet and Web protocols and links
College community: staff, students and other clients

FIGURE 1: 'SUPERHIGHWAY' CONVERGENCE AND THE COLLEGE

- ever-increasing emphasis on equipment connectivity based on networking standards and protocols
- ever-increasing power and functionality of software and its accessibility to users
- way in which the information age is superseding the industrial age, with the information supply doubling every five years and with this rate of change increasing, seemingly exponentially

Information in the context of ILT

Information is a coded representation of an aspect or aspects of reality, which can be used to model the real world. Thus a college management information system (MIS) should hold a model of a real college which can be used to provide a basis for decisions in relation to activities such as resourcing, the range of learning opportunities on offer, student progress and student performance.

Information can be represented and communicated in a number of forms:

- graphic image — static and animated pictures, drawings, graphs and charts
- sound — voice, music, recordings
- text — such as word-processing and Hypertext, a powerful extension which allows automatic links to other documents or multimedia images to be incorporated, selected and followed, as in the case of the World Wide Web
- numeric — to be used for calculation
- data codes — such as reference identifiers in a database
- control and sensing signals — such as equipment instructions

Figure 1 shows information being conveyed to a college community by a communications 'highway' formed from the converging strands of multimedia (sound and video), Internet and broadband communication technology.

Internet technology and approaches, founded on the Internet Protocol (IP) software standard, are becoming all pervasive. In addition to its facilities for world-wide communication, the Internet now provides:

- a rich graphical interface for the user
- the facility to readily incorporate multimedia elements
- ways to navigate material determined by the user, rather than by the producer of information

All of these are highly significant in applying Internet approaches within ILT.

Both people and machines that use information require facilities for:

- input — information must be received for storage, processing and communication
- storage — information must be held for processing and future use
- processing — to calculate, select and sequence the information
- communication — to transfer information either over a local or wide area to where it is requested or required
- output — to create a final presentation of information for use

Some learning technology devices do not contain all of these features. For example, an overhead projector is solely an input and output device. A calculator has input, output and limited processing capability, but only handles numeric information. However, the computer has the capability to handle all forms of information and possesses the complete range of facilities identified above. It is this capability, which is continuously being extended, combined with continuing falling costs that leads to technological convergence. This is nowhere more apparent than in ILT. For example, it is only recently that multimedia (video and sound) and flexible communications have become economic for widespread use yet already these facilities form part of a consumer standard. No longer does output have to be pre-defined. The computer can now be regarded as having the capabilities of a vast interactive and dynamic library.

Information has a key role in the context of education, training and learning. It is required:

- to manage educational organisations, and the learning environments and learning opportunities provided by these institutions
- to manage individuals' learning programmes and processes, for example, for action planning and the recording of achievement
- to form the content of an individual's learning programme

It is this central role that information holds in learning that has led to the current state of convergence in information and learning technology. Figure 2 (see over) provides a model of the aspects of information and learning that further education colleges need to address in their application of ILT.

The concept of 'chunking' learning, into units of assessment and modules for delivery, is introduced into the model as a key element when constructing learning programmes. The aspects of learning inter-relate and need to be linked, for example, through systems for student tracking, for the production and tracking of learning materials and for providing students' learning programmes. Managing organisational change is an essential response to dynamic external change.

This model provides the structure for this handbook, with subsequent sections addressing:

- Learning and the management of change
- Organisational management of ILT
- Learning environments
- Individual learning
- Learning content

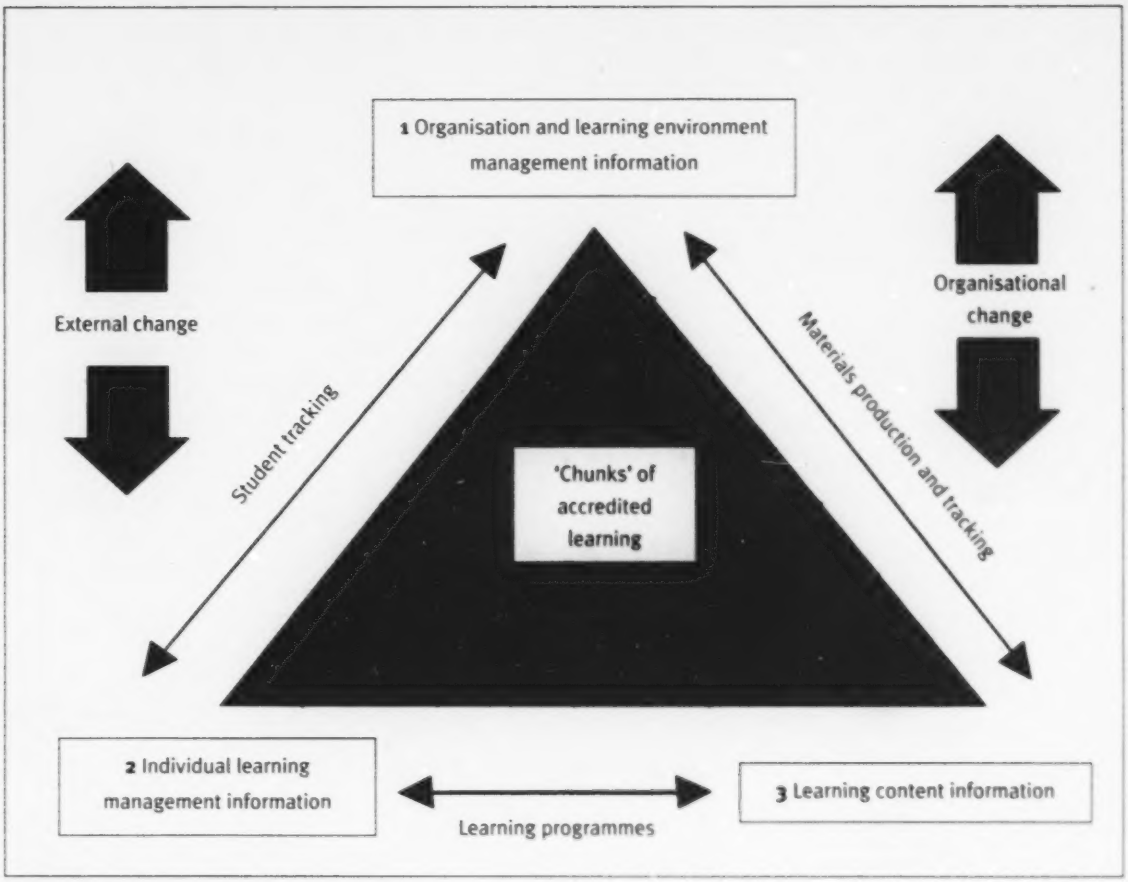

FIGURE 2: INFORMATION AND LEARNING

Key points and quality indicators are then derived from each section to propose a set of categorised ILT quality standards. These are referenced by the section number and coded as being either systems-focused (S), process-orientated (P) or concerned with harmonising systems and processes (H). The significance of using systems, processes and harmonisation for classification is developed in the section 'Quality and planning' in Section 2. The summaries also include pointers on learning and development.

External change factors: summary

Ref	Key point	Quality indicator
1P	Rate of change — reducing cost, increasing capability	System exists for 'scanning' developments and for evaluation and open communication
1H	Convergence, communications and connectivity	Integrated communications and computing strategy is in place
1S	Information impacts on learning and management	Comprehensive information strategy is in place

[S = systems-focused; P = process-orientated; H = harmonising of systems and processes]

Learning and development

1 Does your organisation have the ingredients identified above as quality indicators?

a) If so, how effective are they? How are they reviewed and updated?

b) If not, how are the issues, identified above as key points, addressed, if at all?

2 Should anything be done to improve your institution's response to external change, and if so what?

3 Write down below what you plan to do.

Audit and evaluation points

Action planning points

2. Learning and the management of change

Organisational transformation

One of the most influential pieces of work that has been undertaken on the organisational impact of IT is the MIT 90s project. This five year multidisciplinary research programme was undertaken at the Massachusetts Institute of Technology (MIT), whose sponsors included the British firm, ICL. The first three of of its ten major findings were that:

- turbulence in organisations' environment will continue
- IT capability will continue to improve
- it is necessary to rethink the core of the organisation

The research suggested that IT can provide new methods of working that can extend the reach or scope of an organisation. It suggests that these be addressed as a strategic resource. The transformation model it proposes has five levels, and three stages — evolutionary, transitional and revolutionary. Colleges can use this to inform their organisational needs and the responses they make to the organisations that they service, in terms of training and development needs. The model is outlined in Figure 3.

The National Council for Educational Technology (NCET) has applied the model to the education context in *Managing IT: A planning tool for managers* (1995). (FEDA has used this NCET publication in the launch of its Quality in ILT [QUILT] staff development programme.)

NCET introduces three key terms or features for each of the five levels, which can be used as strategic indicators. These key terms can be used to identify levels within the transformation model. They are tabulated over the page in Figure 4. The resulting version of the model can be used to audit an institution's current state of development and to plan where it intends to be at a specified time in the future, including the action required to reach this point.

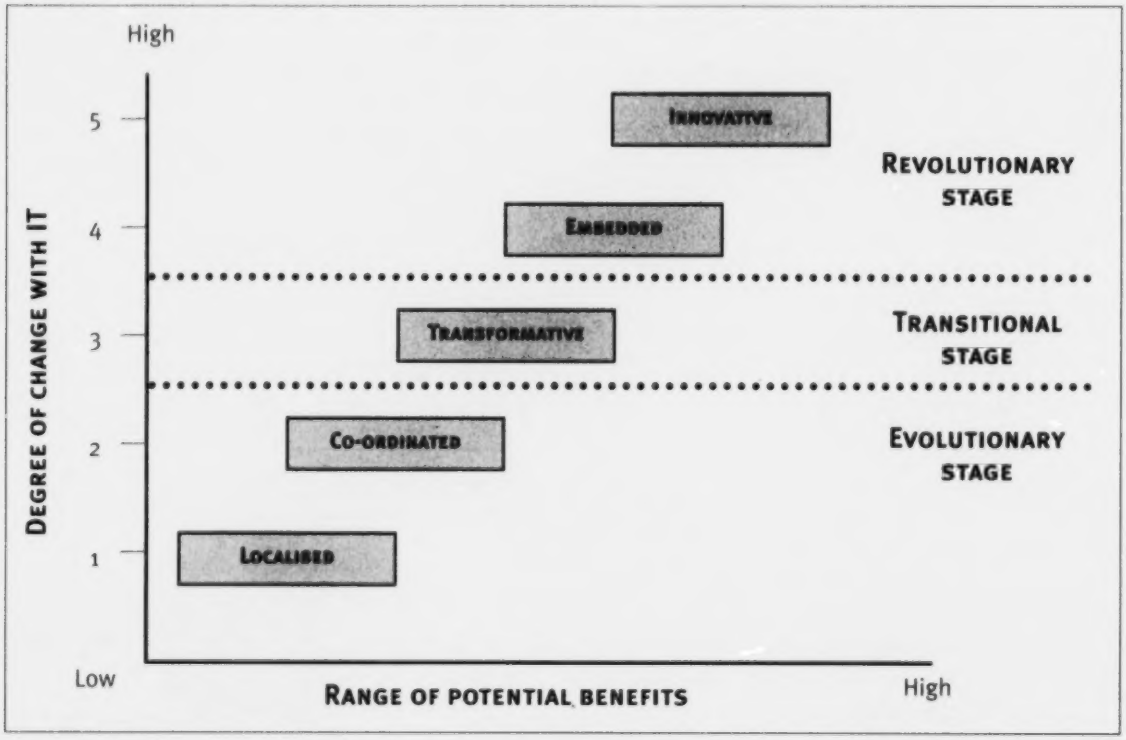

FIGURE 3: TRANSFORMATION MODEL

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Managing IT: A planning tool for managers also includes a profiling and planning matrix, using 14 factors grouped into six categories:

- management
- staff development
- curriculum administration
- resources
- external links
- evaluation

However, this matrix tends to address operational rather than strategic issues. This handbook attempts to address these overarching strategic issues with the key points and quality indicators included as a summary to each section.

MIT identified the following as conditions that are required for transformation to take place:

- a shared vision on how the organisation should be developed
- flexible human resource practices
- investment in education and training
- a readily available infrastructure

The transformation model also features in the Learning Environment Architecture project described by Ford et al (1996) in *Managing Change in Higher Education*. This book contains a wealth of material relevant to the management of educational change. Of particular interest is the attention given to a 'learning chunk', which is defined as:

> *"a bounded learning activity with a specified set of learning objectives and a set of assessment procedures capable of testing to what extent these outcomes are met by students". (p57)*

Again, development of the infrastructure is identified as a key stage in managing change.

A learning organisation

Implicit in the transformation model and earlier historical analysis is the need to develop an organisational culture of change, which requires a focus on learning often identified as the need to become a 'learning organisation'. In his book *The Learning Organisation and the need for Directors who think*, Garratt acknowledges the work of Professor Reg Revans, who is recognised as the founder of action learning, an approach which remains highly influential in the field of management development. Garratt uses Revans' equation, expressing the relationship between learning and change:

$$L \geq C$$

This states that for an organisation to survive, its rate of learning (L) must be greater than or equal to the rate of change in its external environment (C).

Strategic level of IT application	Strategic indicator/ Key term 1	Strategic indicator/ Key term 2	Strategic indicator/ Key term 3
Localised	Individual	Experimental	Unco-ordinated
Co-ordinated	IT Policy	Staff development	Student entitlement
Transformative	Consolidation and evaluation	Exploration of IT potential	Recognition of change in teaching and learning strategies
Embedded	Changing teaching styles	Resourcing for changing needs	Accountability
Innovative	Redefined staff roles	Culture of change	Active exploitation of IT

FIGURE 4: KEY TERMS FOR EACH LEVEL OF THE TRANSFORMATION MODEL

The rapid development of ILT and continuing, if not accelerating, turbulence in the external environment demonstrates the need for a high rate of learning for those working in colleges. The challenge for colleges can be epitomised as the need to truly become 'learning organisations' and to practise in their management, organisation and operation what they 'preach' to their students and customers.

In examining learning, Revans also proposes a learning equation which is:

$$L = P + Q$$

This expresses an organisation's learning (L) as the sum of programmed instruction (P) and questioning insight (Q). The learning equation is equally applicable to an individual's learning. Revans argues that there is a tendency to focus on P, at the expense of Q, and this is certainly the case in the English education system. An overemphasis on P can provide a major block to learning. In learning to learn, it is essential for learners to ask discriminating questions so that they focus on learning. This should be given particular attention when applying ILT, where there is an inherent danger of focusing on content, that is P. The Internet provides some interesting examples which can be used to develop a questioning approach in the context of ILT. One of these is the convention of collecting and banking lists of 'Frequently Asked Questions' (FAQs), and their answers, for general reference. It is also worth considering how much electronic conferencing and group working facilities can be used to promote questioning.

Revans also identifies "four corrigible handicaps" which can block organisational learning. These are the:

- idealisation of past experience
- charismatic influence of (other) successful managers (or learners)
- impulsion to instant activity
- belittlement of subordinates

All of these are important enough to be borne in mind when developing ILT, to help avoid barriers to organisational learning.

An essential part of learning is the promotion of teamwork within the whole organisation. To succeed, all team members should:

- be prepared to give in order to take, and to listen in order to talk
- be committed to a common purpose
- practise openness and consistency
- provide support and help
- share ignorance and insecurity as well as information, knowledge and experience

Nowhere is the challenge to learn greater than in the use and effective application of IT. The strengths, weaknesses, threats and opportunities (SWOT) analysis, often applied to the context of change, can be adapted and applied to the profiling of all staff involved with ILT. Staff can be profiled on a scale of 'experienced or inexperienced in the use of IT' and of 'threatened or stimulated by change' (see Figure 5). The task for management is to remove or challenge threats and insecurities, and provide staff with the maximum opportunity to obtain effective experience. Experienced staff who are threatened or insecure (Threatened and Experienced, that is TE in the adapted framework of Figure 5) are often the 'gatekeepers' to IT. There is a danger of conferring the status of 'expert' on such people. In a field as dynamic as IT development, the static concept of the expert is both invalid and inappropriate. It acts as a barrier to, rather than enables and stimulates, potential and development. Conversely, experience and expertise in IT applications, along with a capacity to be stimulated by change (Stimulated and Experienced, that is SE), provides a combination to be highly valued, if the experience is applied effectively. A high degree of polarisation exists between the TE and SE categories, which represent people who have been highly exposed to technical change, with the constant learning and 'unlearning' that this

demands. The need to unlearn in the context of learning, albeit paradoxical, should not be underestimated. Each wave of development renders redundant and irrelevant a high proportion of the knowledge and techniques required for working in the previous wave. This knowledge must be unlearned as it can provide a barrier to acquiring the knowledge and techniques necessary for effectively riding the new wave. There is a core of experience which is valid and useful at every stage. An ability to know what to discard and what to retain is critical. This can be likened to identifying what experience constitutes a 'dead branch' and what remains on the main stem of the evolutionary tree of development.

It is questionable whether there can be any place for TE people in a learning organisation. It is the SE people who become successful in 'learning to learn'. Their skills and experience should be harnessed to develop and support both categories of inexperienced user (Threatened and Inexperienced, that is TI, and Stimulated and Inexperienced, that is SI). There is always a danger with SI staff that they are, or become, 'obsessed with change' and technology, and focus on gadgetry rather than on investment in effective solutions.

For the effective application of ILT, it is essential that staff development and learning are prioritised in order to develop SE people. In the case of a college or school, staff development should mirror the learning experiences and approaches used with students. The challenge is that the staff's learning (L) needs to be greater than or at least equal to the change in knowledge and experience of students (C) in relation to IT.

Quality and planning

One of the central purposes of education is to improve the quality of life through learning. Planning is a key activity in the learning process, as is the review and evaluation of how effective a learner's action plan has been. Similarly, planning has a critical role in the context of improving institutional quality and of coping with change. It is dangerous to prepare plans which are not integrated or harmonised

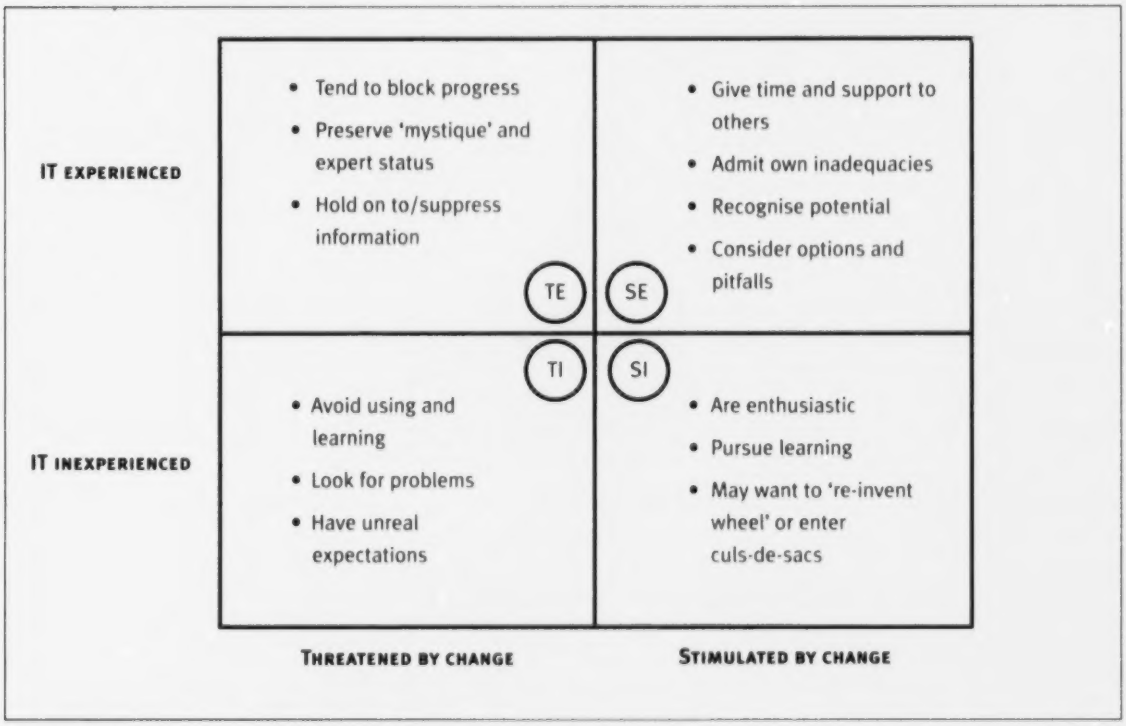

FIGURE 5: SIMPLIFIED IT STAFF PROFILING MODEL

with the reality of the institutional context and culture, and where an 'implementation gap' exists. This situation, described by Hoyle (1986) as 'organisational pathos', is represented in Figure 6, alongside the ideal where the plan is well integrated with organisational reality, through achieving effective management (Cowham, 1995).

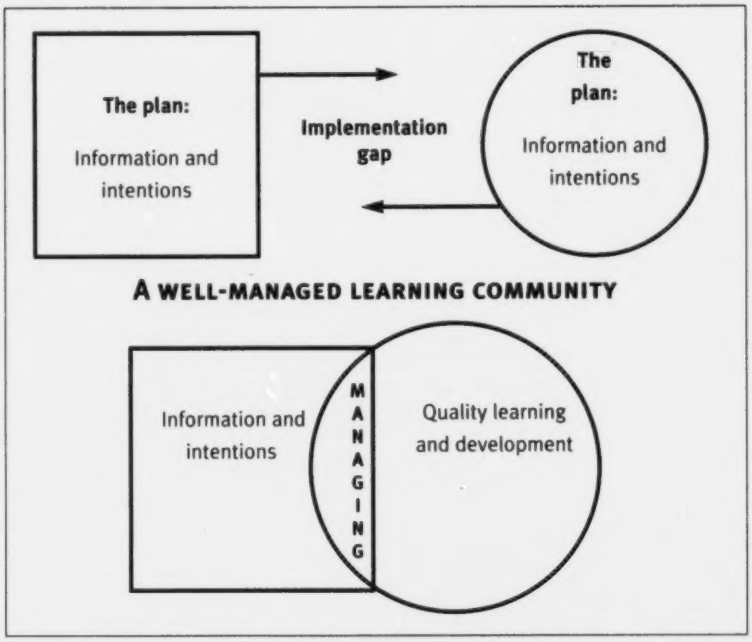

FIGURE 6: STRATEGIC PLAN AND THE IMPLEMENTATION GAP

In the model the squares, with their hard edges, are used to represent products, systems, plans and procedures, while soft-edged circles are used to represent the cultures and processes required to develop and implement plans. In reality, complex organisations will consist of a web of overlapping circles or sub-cultures. In a learning organisation there will be a free and open exchange of information and knowledge between teams, represented by the overlapping circles in Figure 7.

Future plans and present reality, systems and processes, and procedures and cultures must be integrated and harmonised, as represented by the zone where the square and circle overlap. This is the zone where effective management, learning and quality can be achieved. This model can be applied to the application of ILT by replacing 'the plan', in the isolated square in Figure 6, with 'technology'. It can then be used to represent the effective or ineffective institutional implementation of ILT as shown in Figure 7. Ineffective application would mean separation rather than integration of the square and circle.

A generic model for quality systems and processes, using the same symbolic approach, is presented in Figure 8 overleaf (Cowham, 1995). In the square the emphasis is on control and maintenance, which is often stereotyped as the ISO 9000 approach (the international kitemark awarded for demonstrating effective systems for quality control, also known as the BS 5750). In the circle the emphasis is on assurance and development which might be associated with Total Quality Management (TQM) approaches.

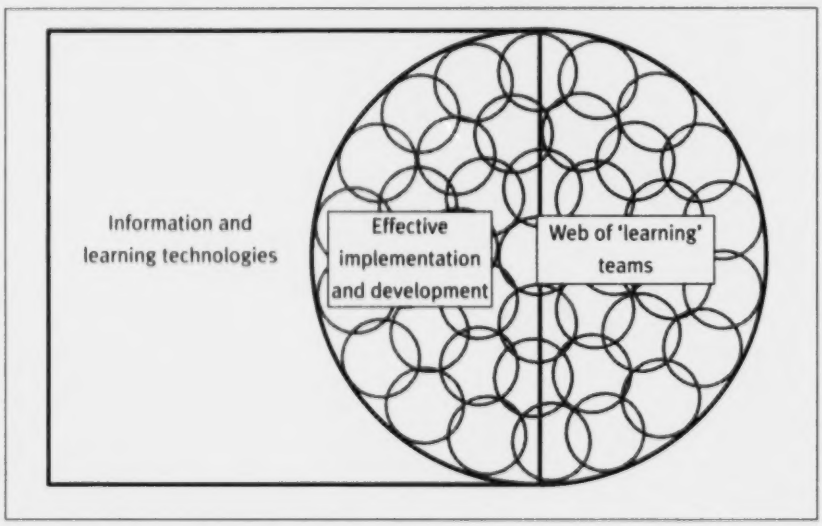

FIGURE 7: ILT AND A LEARNING CULTURE

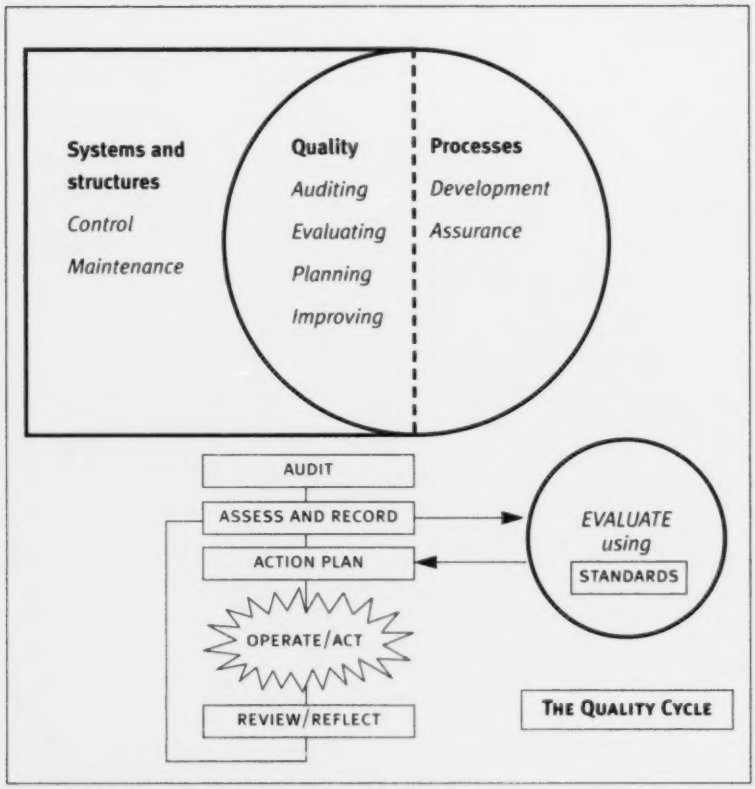

FIGURE 8: QUALITY, SYSTEMS AND PROCESSES

Development cannot be embedded without systems for control, while systems can be made over-rigid, misapplied and stifle development so the two approaches need to be harmonised to create a 'quality zone'. The activities that form a quality cycle are given in the flowchart. This begins with an audit of the situation, which requires evaluation and hence the application of standards. This must be undertaken before a plan of action can be drawn up. After a period of action, both review and reflection are a necessary pre-requisite to evaluation. The flowchart has no exit, as the cyclical approach is consistent with the concept of continuous improvement. Quality standards must be applied for improvement to be achieved. This process provides a focus for identifying what is valued and practical within the organisation's culture. The adoption of 'open' standards in the development of IT has been equally critical. In addition to the *de facto* industry standards, generally recognised and accepted across an industry, there are *de jure* international standards such as ISO, and the restricted proprietary standards used within individual organisations.

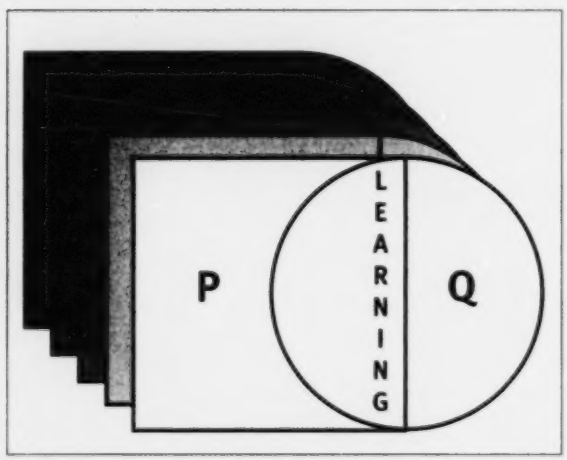

FIGURE 9: LEARNING EQUATION OVER TIME

Robert Pirsig in *Lila* proposes a metaphysics of quality which distinguishes between static quality (square) and dynamic quality (circle):

> *"a dynamic advance is meaningless unless it can find some static pattern with which to protect itself from degeneration back to the conditions that existed before the advance was made. Evolution can't be a continuous forward movement. It must be a process of ratchet-like steps in which there is a Dynamic movement forward up some new incline and then, if the result looks successful, a Static latching-on of the gain that has been made: then ..." (p176)*

Each development phase requires an audit review and improvement of static systems. There is a close match between the quality cycle and the process of learning inherent in portfolio-based assessment. Applying the model to the learning equation, 'P' implies programming bounded by a square, while 'Q' implies questioning bounded by a circle. Over time the circles should form an ascending spiral with the squares forming a supporting series of steps. Figure 9 provides a representation of this effect.

Learning and the management of change: summary

Ref	Key point	Quality indicator
2H	New technology requires the transformation of the college	The college has identified its current level in the 'transformation model' and is addressing the impact of ILT on transformation
2P	A culture of learning and teamwork is required	Listening and the sharing of ignorance as well as knowledge is positively encouraged
2S	The quality cycle provides a basis for development and for harmonising systems and processes	Quality standards are agreed and applied in audit, review and planning across the college

[S = systems-focused; P = process-orientated; H = harmonising of systems and processes]

Learning and development

1 Use the table in Figure 4 to audit your college's current stage of development in the application of ILT.
   a) At which level in the transformation model in Figure 3 would you currently place your college?
   b) At which level in the transformation model should it be placed in three years' time?
   c) Identify three priority planning issues which need to be addressed to get from **1**a to **1**b.

2 Where do you fit in the 'IT staff profiling model' (Figure 5)?
   a) Apply the categories in Figure 5 to a team of colleagues.
   b) Identify three staff development planning priorities to convert TI and SI staff into SE staff in your college.

3 Apply the implementation gap and integrated models from Figure 6 to your college.
   a) Identify an area or situation in your college where systems and processes are not harmonised and where there is an implementation gap.
   b) Identify an area or situation in your college where systems and processes are harmonised.
   c) What are the quality systems and processes that can be applied to ILT in the context of Figure 7 in your college?
   d) How can the systems and processes identified in **3**a above be better harmonised?

Audit and evaluation points

1 a
   b

2 a
   b

3 a
   b
   c

Action planning points

1 c

2 b

3 d

3. Organisational management of ILT

Application and infrastructure

For an ILT strategy to be successfully implemented an efficient infrastructure, which can support effective applications of the technology, must be developed. The infrastructure of hardware, networks and software, with appropriate staff roles, is concerned with the development and operation of systems and standards. Creative processes are required when applying the technology to explore its capability, including its impact and effectiveness and the design of quality learning experiences. The result should be learning materials or 'courseware' which comprises computer-based resources and material, but may also include supporting paper-based materials. Courseware should encompass content material, learning activities, assignments and assessments along with the means for tracking, monitoring and recording student progress.

With ILT, learning may involve the medium as well as the message. In other words, using IT will enable learning about the capability of IT and also develop skills in using the technology.

There is a danger that learning activities focus on P (programmed instruction) to the exclusion of Q (questioning insight). To avoid this, quality courseware should include investigative activities where IT provides a rich source of information as well as interaction with other students or peers and the tutor, and/or mentor.

Effective applications require investment in and hence support from an efficient infrastructure. Without this, applications will never be embedded. There is the inherent danger, however, that attention and resources are committed to establishing an infrastructure which does not result in effective application. The infrastructure is required to support, not to dominate or determine applications. The priority must lie with pedagogy and achieving effective learning applications.

Inevitably, new roles and functions are required to support the infrastructure and to develop the application. Indicative information is given in Figure 10 below. This links with the 'changing teaching styles' associated with the embedded strategic level, and with the 'redefined staff roles' associated with the innovative strategic level of the MIT transformation model described in the previous section. An implication of ILT development has been the 'atomisation' of the role of the teacher into a range of specialist functions.

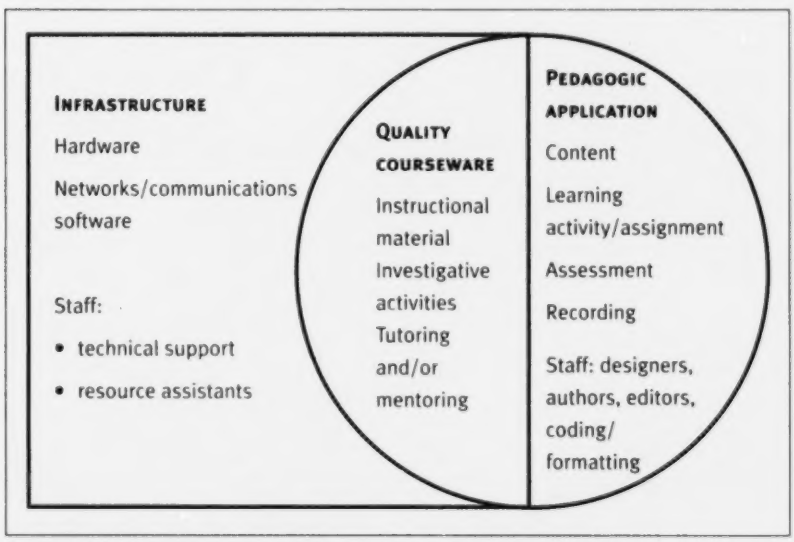

FIGURE 10: HARMONISING APPLICATION AND INFRASTRUCTURE

Future-proofing

The term 'future-proofing' refers to the challenge of anticipating developments so that there is a profitable return on investment in technology infrastructure and in development time. It demands pro-active strategies for hardware and software acquisition and development but, more significantly, for staff and applications development. To survive, strategic partnerships must be

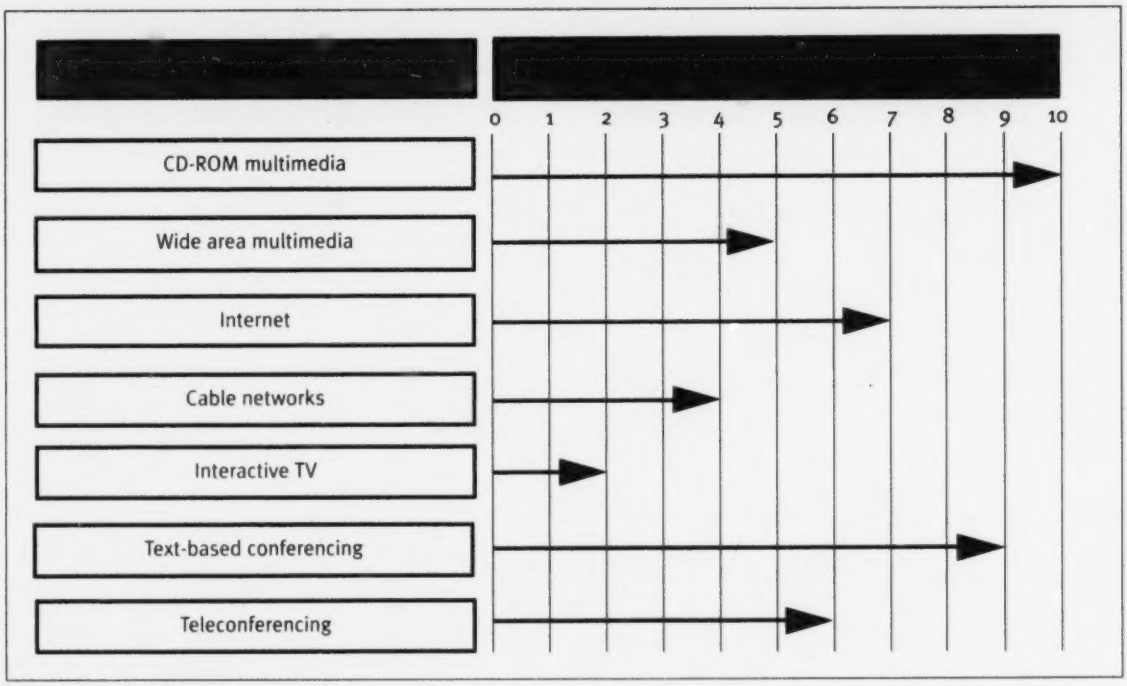

FIGURE 11: TECHNOLOGY 'DRIVERS'

developed with complementary organisations with technology interests and expertise, while concentrating on quality and flexibility of applications. The continuous scanning and review of influences in the external environment is essential. This requires assessment of the maturity/readiness of emerging technology and of the evolution of 'industry standards'.

An industry standard is where a particular product or standard comes to dominate applications in the marketplace. The pursuit of industry standards is important since it ensures that you stay within the mainstream of evolution and development, rather than becoming stranded in an offshoot or 'dead branch'. The clearest current examples are the 'PC' standard, derived, albeit unintentionally, from the IBM PC and resulting in a *de facto* open systems standards based approach, and Microsoft PC operating systems (DOS and Windows) and applications (Word, Excel and Access and so on). Figure 11 above, adapted from a presentation by Rob Arntsen of IBM, maps a number of emerging technologies against a maturity scale of 0 to 10. All of these technologies are likely to impact directly on the future of further and higher education.

The lower the score on the scale, the less likelihood there is for an industry standard to have evolved and the greater the risk in investing in a particular product or solution. Although, conversely, there is a longer lead time for experimentation and learning.

A high score for a 'driver' will probably mean that a clear industry standard has emerged and that convergence has matured with low cost, high capability computer-based solutions. The importance of latching infrastructure and development into an industry standard at the earliest opportunity cannot be overstated.

Curriculum management

Many of the issues relating to curriculum management have been addressed when dealing with infrastructure and applications. The production of quality courseware depends upon a clear understanding and analysis of the curriculum. ILT offers potential to provide individualised learning.

Flexible Colleges (FEU, 1991) offers an analysis of the differences between a course-based college and a learner-centred college.

Six key areas are identified:

- marketing and outreach
- threshold services
- flexible access to learning
- flexible access both to assessment and to accreditation
- supporting learning
- infrastructure

The effective application of ILT necessitates and enables the development of a flexible college. Figure 12 below provides a learner-centred curriculum model. Threshold services provide for initial assessment and diagnosis, learning programme selection and induction. Learning resources provide the infrastructure for and content of learning, while tutorial is concerned with learning processes. Core or key skills occupy the zone of harmonisation. They are concerned with key learning skills including learning how to learn and improve performance, as well as being able to effectively use and apply IT. Modularisation and unit accreditation are concerned with the systems for and organisation of learning into chunks, which has been referred to earlier. For learning resources to be organised into learning modules it is necessary to break down assessment into appropriate units of credit. Modularisation will impact on and be impacted by the organisation and operation of learning resources. Similarly, unit accreditation will impact on tutorials and the management of learning.

The critical role of tutorial systems and processes in the management of learning is addressed in Figure 13 (see over). In Figure 12 the tutorial is identified as being primarily process and culturally focused (circle), while resource-based learning and the management of content is primarily systemic (square). When addressed in more detail, the tutorial has both a systemic and a process aspect. This is probably true of all systems and processes when detailed. In Figure 10, tutoring is placed in the 'quality zone', where infrastructure and applications are harmonised. Either way, the systemic aspect of tutoring is concerned with underpinning development with a formal recording and planning system to support learning, similar to the quality cycle in Figure 8. Assessment is the formal outcome of the systemic aspect, which is increasingly likely to be portfolio-based, while for the process aspect it should be the development of skills for progressing in life through study or employment, for example. ILT-based approaches need to be able to support the systems and processes shown in Figures 12 and 13.

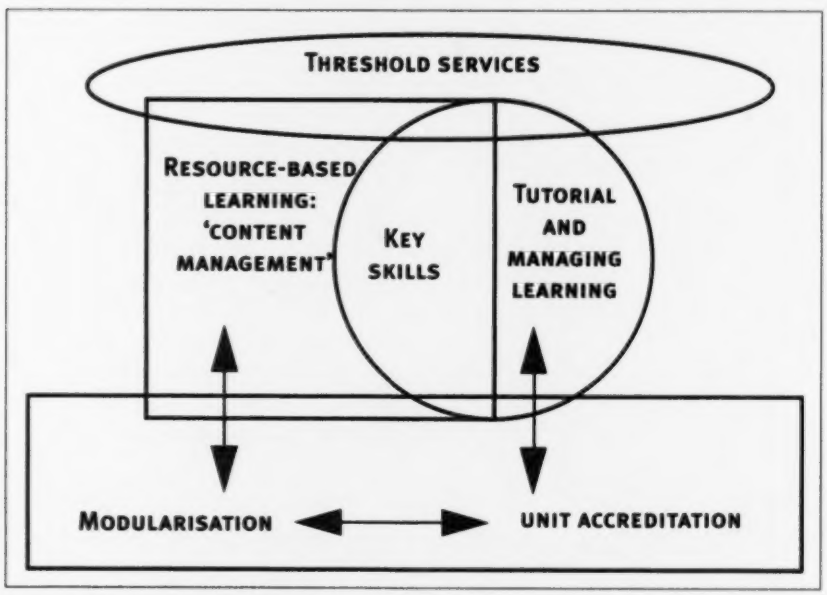

FIGURE 12: CURRICULUM MODEL

Information management

The challenge for colleges is to develop and organise information systems which integrate management and external accountability requirements with the need to track and support individual students' learning requirements. Figure 14, taken from a report by Kay (1994), maps the information requirements of colleges across the

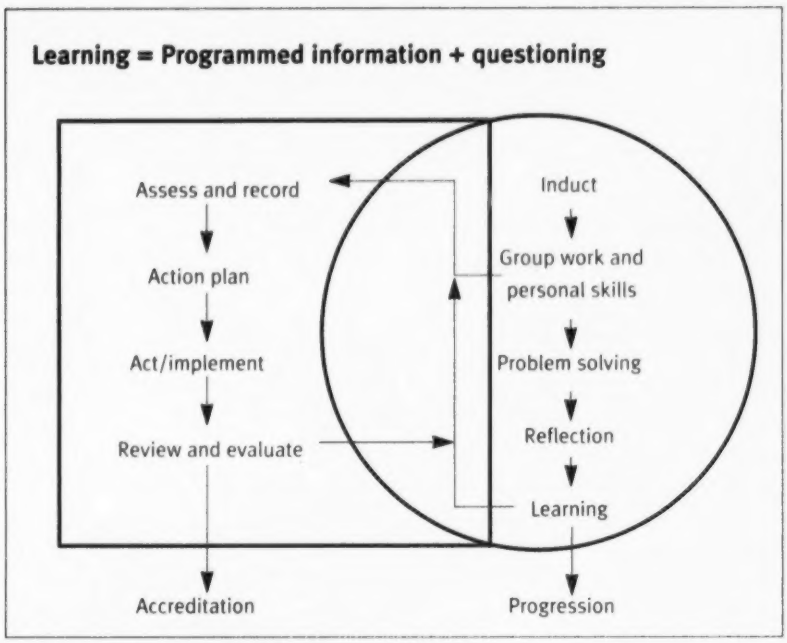

FIGURE 13: TUTORIAL SYSTEMS AND PROCESSES

domains of 'Learning and delivery' and of 'Management and administration'. A major problem in meeting the challenge of integration is the complexity and turbulence currently associated with the organisation and funding of colleges, as well as with the volume and volatility of information involved. However, to ease matters there is a direct relationship between an Individual Student Record (ISR) required for funding claims and the detailed performance recording of that student, offered by some NVQ tracking systems. The technical term for these different levels of detail is the amount of 'granularity' required in a system. Most college management information systems (MIS) are only capable of providing a low level of granularity and address management and administration only.

An MIS model is presented in Figure 15, which incorporates information on 'chunks' in the form of a bank of units linked to a bank or store of modules. While it does not include all the elements featured in Figure 14, it shows the logical relationship between the key elements involved in resourcing learning and the information required to claim funding. The model also reflects the information requirements of the Further Education Funding Council (FEFC), based on an ISR linked to a qualification aim. Resources are linked to curriculum delivery in the form of module information. Units of assessment on the other hand are the means by which funding is attracted (since funding is claimed from information submitted on the ISR). Learning and delivery are integrated in the form of an assessment bank and bank of learning materials. This indicates one means by which management information can be integrated with learning environment information. Increasingly, tracking systems will need to be capable of providing a high level of granularity, linking assessment information to learning resource information in the form of learning materials. These may include multimedia-based as well as text-based materials. FEDA's current work on college information requirements and student tracking is attempting to describe the systems and processes involved in order to produce a specification, for example, for an effective student tracking system.

An important issue that must not be overlooked is indicated in Figure 14 as 'services security'. Allowing unrestricted access to institutional information, both within the organisation via local area networks (LANs) and beyond via wide area networks (WANs), presents a security challenge. The ever-increasing sophistication, integration and convergence of ILT is accompanied by an ever-increasing challenge to maintain security and integrity of information. Adopting software and hardware solutions that have a security filter (a process known as firewalling), as indicated in Figure 18 in the following section, would provide a partial solution to this problem.

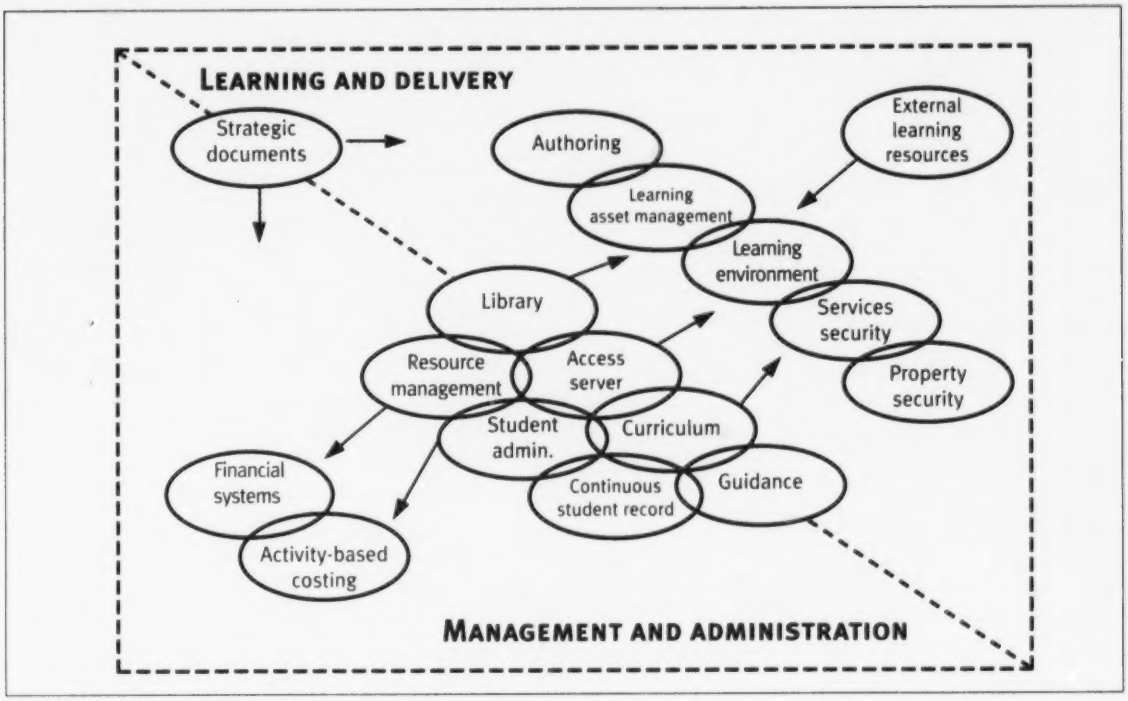

FIGURE 14: MAP OF INFORMATION MANAGEMENT REQUIREMENTS

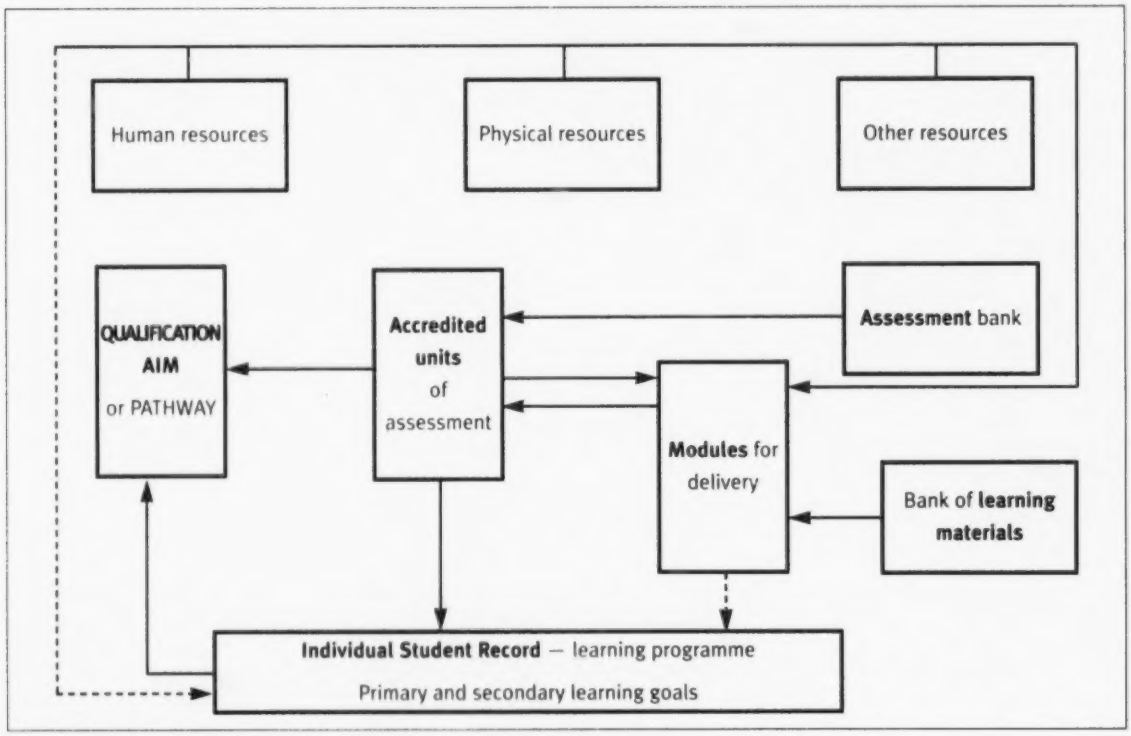

FIGURE 15: AN MIS MODEL

Organisational management of ILT: summary

Ref	Key point	Quality indicator
3S	A planned institutional infrastructure is required	Industry standards are reviewed and applied
3P	Flexible human resource practices are needed	Staff roles have been developed to support the infrastructure and applications development
3H	Learning and management systems must be integrated	Computerised tracking systems are being developed and applied for student progress and/or learning materials

[S = systems-focused; P = process-orientated; H = harmonising of systems and processes]

Learning and development

1 Consider the technology drivers proposed in Figure 11 in the context of your college.

a) Analyse why, how and when each of the identified technology drivers will effect your college, if at all.

b) List at least three action planning points to ensure your college is anticipating and preparing for their effect.

2 Consider the map of information management requirements, suggested in Figure 14, in the context of your college.

a) How many of the elements identified are currently being addressed in your college?

b) How are they, and learning management systems in general, being co-ordinated and harmonised?

c) Identify any elements which are not currently being addressed which you believe should be. Provide an action point for each of these.

3 How does your college bank assessments and learning materials? What is the potential for extending the use of IT in these application areas in your college?

Audit and evaluation points

Action planning points

4. Learning environments

One of the main functions of a college is to provide effective learning environments for a range of communities of learners. The learning environment must allow access to structured content as well as provide systems for support and for recording progress and achievement.

Normally, a learning centre, containing learning resources including content-related ones, will form the main focus for the learning environment. Learning centres may be college based or located external to the college on the premises of an employer or in the community. Figure 16 represents these different locations.

Increasingly, learners may also require remote individual access to learning resources and systems. The challenge is to model learning environments using ILT.

The current vogue is to use 'virtual' as a prefix to identify an IT-based approach. Thus to provide a virtual learning environment, ensuring flexible access to learning materials, 'virtual' tutor systems must be developed which provide facilities that match a 'real' tutorial system.

Figure 17 illustrates a model proposed by David Wardell from Manchester College of Arts and Technology (MANCAT). This model has three main components:

- learning material, identified as modules
- tutorial and assessment support, based on assessment by portfolio
- a 'support system' providing workshop and conference support

Induction is based on initial audit assessment using a 'smart portfolio' (as in 'smart card'), indicative of an on-line computer based facility. With these components the model provides a design for a system which addresses the learning elements covered in Figures 9, 10 and 13 above. The more remote the learner, the greater the need for a fully comprehensive and completely specified system to support their learning and provide them with a rich learning environment. In the context of Figure 16 there will be a greater tolerance for errors and 'missing' elements of a learning system in the college-based learning centre. These can be remedied by the availability of on-hand tutors who can adapt to unforeseen needs and

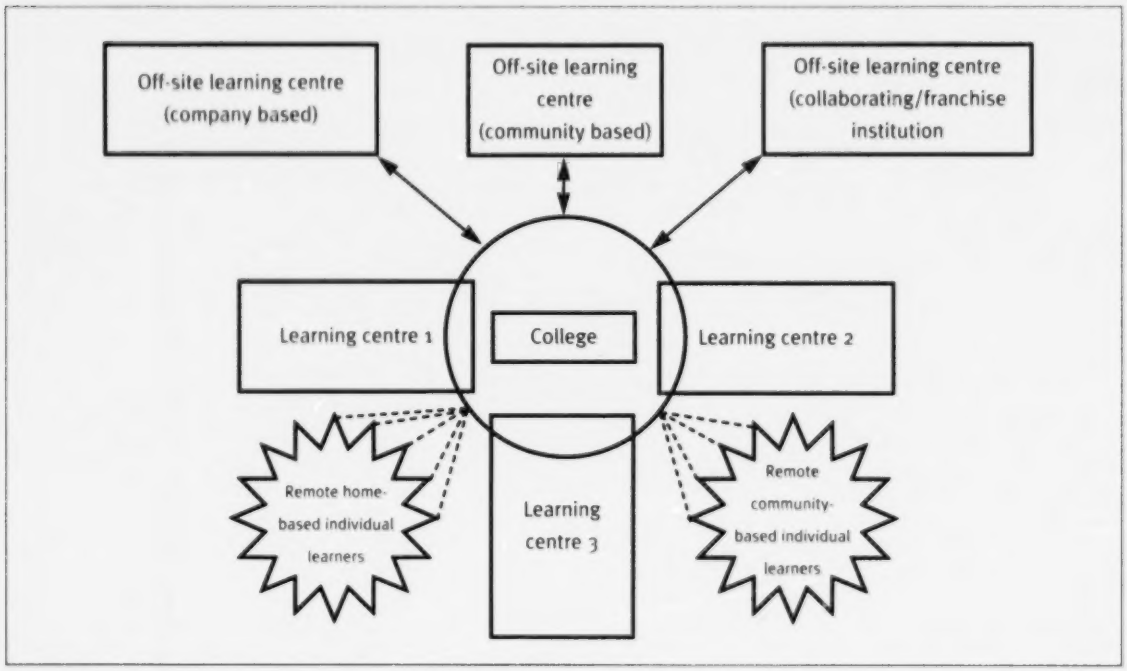

FIGURE 16: LEARNING ENVIRONMENTS AND THE COLLEGE

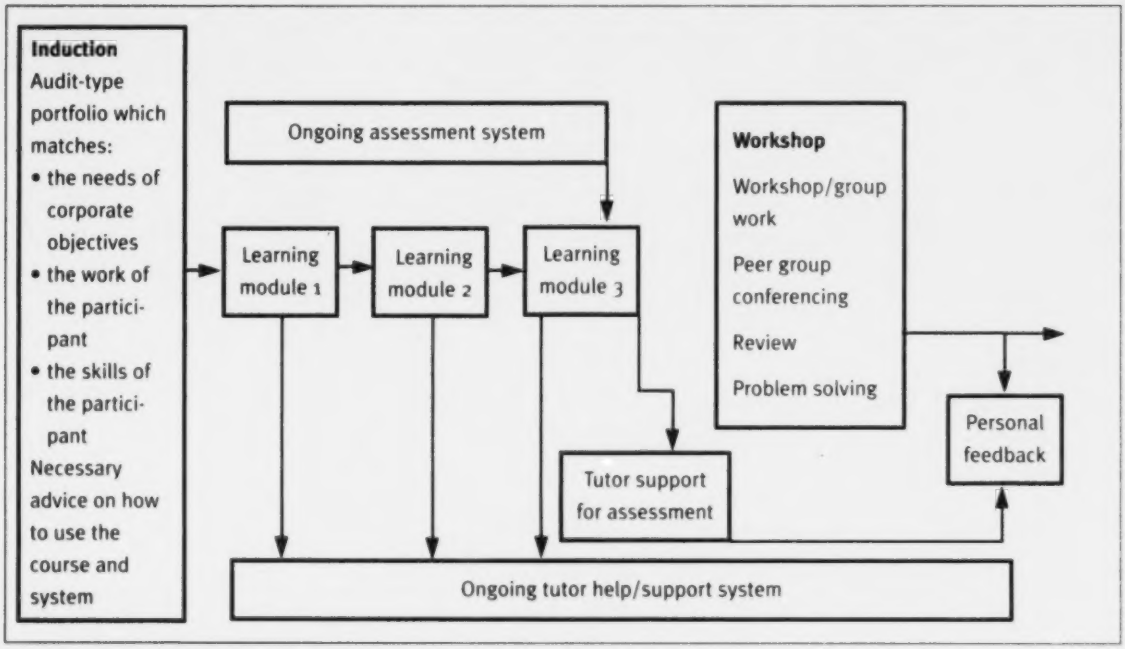

FIGURE 17: SUPPORTING ON-LINE LEARNING

problems. Off-site learning centres will retain some of this tolerance and flexibility in terms of systems, but will generally require systems and standards to be more rigorous. The remote individual learner is seen as offering the ultimate challenge.

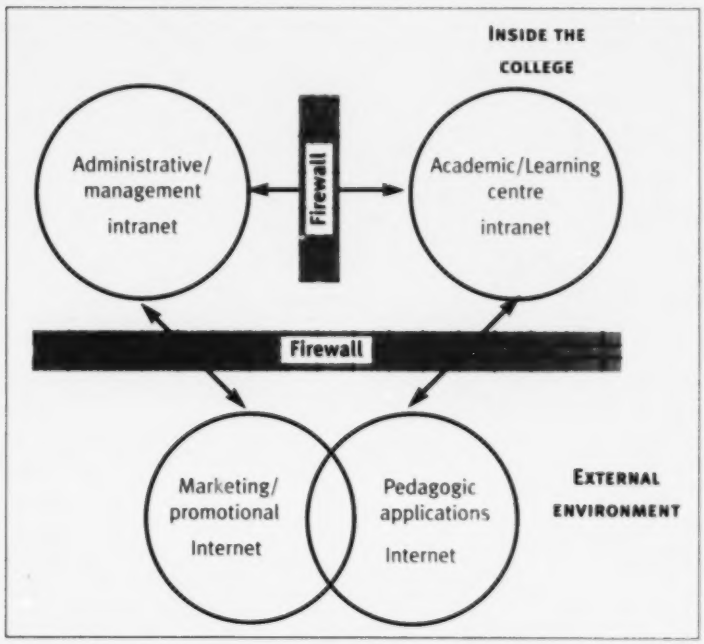

FIGURE 18: COLLEGE SCHEME FOR INTER- AND INTRANETS

Figure 17 is based on using the Internet for supporting on-line learning for remote learners. It is recommended to prototype Internet-based solutions by developing an intranet to test out materials and solutions in the context of on-site learning centres. With an intranet, hypertext pages can be stored and accessed over a local area network using the same software that accesses the Internet. Intranets provide a 'safe' environment for learning with and testing Web-based systems and techniques. Figure 18 suggests a scheme for Internet and Intranet development within a college. The scheme indicates that there is a need to separate information used for management purposes which will increasingly be made available for Web-based access, from learning content and support material. Giving students direct access to the former could present serious security hazards for management and confidential information. Hence the need for a 'firewall', which is the technical term adopted for hardware and software solutions that provide a security filter.

However, there is a need for the facility to exchange information between the two intranets, using the same hardware and software approach. Similarly, there is a need for the two-way exchange of information between the intranets and the Internet, but the security risk is even greater again requiring 'firewalling'.

Figure 19 illustrates IBM's 'learning solution architecture', as described in Arntsen and Sheddick (1996). The competency advisor aims to help students audit their existing knowledge and skills and so to build an action plan. CD-ROM's are being developed to provide multimedia content in areas such as Customer Services and Business Administration. Software has been prototyped to assist in the administration and management of learning centres. The functions identified under the section 'personal learning systems' include the tools for tutors to author 'content'. The facilities included as supporting the 'distance learning backbone', such as 'discussion groups', map directly against the 'tutor support for assessment', 'ongoing tutor help/support' and 'personal feedback' functions in Figure 17. Arntsen and Sheddick go on to state:

"the challenge then is for tutors to learn about learning so that they in turn can teach their students to learn how to learn ....

"the creation of new learning ... environments will require that teachers work in ... new partnerships which include publishers, editors, graphic designers, video producers, subject experts, psychologists and computer companies".

Fretwell-Downing Data Systems is developing software for supporting the management of a learning environment. This will include facilities for tracking students' learning and for content management. (See Web site HTTP://www.fdgroup.co.uk for information on its development.) What makes it unique is that a dozen colleges, including those in higher education and an Open College Federation, are involved in specifying, testing and piloting the software. Because development is in a pre-competitive phase, this co-operation allows the organisations to pool experience and learning to the potential benefit of the final product. The development of ILT as a whole is also in a pre-competitive phase. It too would benefit from partnership approaches for 'learning together'.

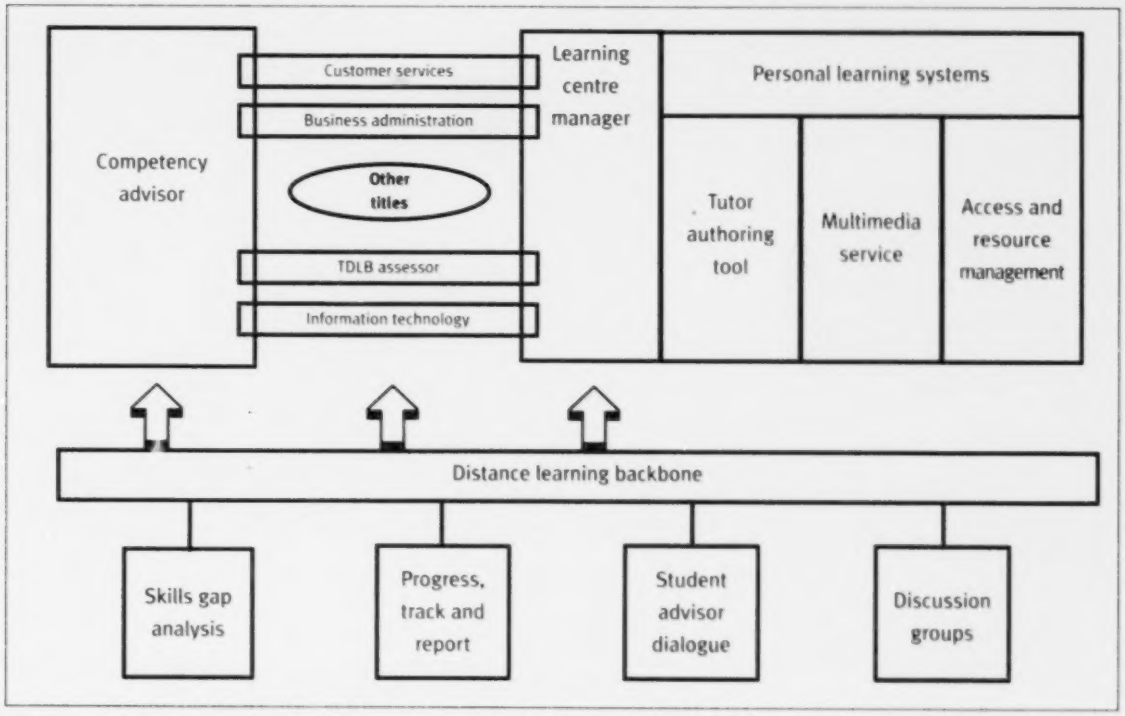

FIGURE 19: IBM LEARNING ENVIRONMENT — SOLUTION ARCHITECTURE

Learning environments: summary

Ref	Key point	Quality indicator
4H	Programmes of content need to be organised into 'chunks' or modules	A strategy is in place for curriculum unitisation and/or modularisation
4P	Tutors need to provide the necessary support to allow students to develop a questioning approach to learning	A tutorial system is integrated with learning centre provision
4S	ILT must be an integral part of learning centre development	Learning centres have linked and co-ordinated computer networks

[S = systems-focused; P = process-orientated; H = harmonising of systems and processes]

Learning and development

1 What score would you give for the stage of development of your college learning centre using the scale given in Figure 11? What score should it have in three years' time? Produce at least three action points to enable your institution to get there.

2 Use the same approach to score and plan Inter- and intranet development.

Audit and evaluation points

Action planning points

5. Individual learning

Tracking and recording planned learning and achievement are vital for allowing effective management of an individual learning environment. People learn from each other and through human contact. It is worthwhile examining how much ILT helps to extend human contact through conferencing systems, bulletin boards and so on, but also how much it may provide barriers to such contact and the spontaneity that comes from the close contact of people meeting and working in groups.

All learners have differing needs. ILT offers great potential in responding to these needs, both in the pace that individuals progress and in the sequencing of learning steps and stages. The following extract, from a discussion headed 'Hypertext and the growth of understanding' on the uk.education.16plus Internet Bulletin board (30/10/1996), is relevant here:

> *"The advantage of a good hypertext system is that it enables the learner to structure their own learning to suit their own cognitive style ... there are a multitude of definitions of cognitive style, but an enduring one is that of 'serialism' Vs 'holism'... 'Serialists' tend to prefer to learn facts in linear or sequential fashion, relying on factual detail and logical analysis.... 'Holists', on the other hand, tend to prefer to learn in a more global fashion, starting by mapping out the overall subject area..."*

It is tempting to place serialists in a square and holists in a circle (see page 19). *Learning Styles* (FEDA, 1995) takes Honey and Mumford's work on learning styles, developed from the stages in Kolb's learning cycle (1984), and determines at which stage different learners are most comfortable. This is summarised below:

Kolb Stage	Style	Summary
1 Having an experience	Activist	I'll try anything once
2 Reviewing the experience	Reflector	I'd like time to think about this
3 Concluding from the experience	Theorist	How does this fit with that?
4 Planning the next steps	Pragmatist	How can I apply this in practice?

Learners benefit from exploring their personal learning style and then using it in the way that they learn. ILT will allow them to explore content in their preferred style and to manage their learning. Providing tracking and recording facilities requires a high level of 'granularity' in terms of the detail stored. To adapt ILT to different learning styles it is necessary to understand the components of each style. Honey and Mumford's four styles provide one model; more research is required before ILT can be used to maximum effect in this capacity.

The most interesting ILT key skill is learning about and with IT. Figure 20 provides a development model for tutors and learners. An important first stage is the acquisition and accreditation of key skills (S1). This should be undertaken using generic and industry standard packages, such as Microsoft Office Professional. Key skills should be applied flexibly and appropriately across the curriculum (P1), using IT as a tool. This should include team-based activities, for tutors and students, which involve exploring appropriate applications. Some learners and tutors will need to develop specialist IT knowledge and skills (S2) and this should also be accredited. Most important of all in the context of achieving a learning culture is personal and team development (P2). Through exploration this should extend the knowledge, skills and potential of the whole learning community.

The rate of change of hardware and software capability impacts on the accreditation of key skills. Should learners have to access the Internet to develop information-handling skills and should they have used a 'search engine'? Or should it be possible to have IT key skill accreditation without having done either of these? As IT capability develops, tasks can be achieved more easily and instinctively and so there is a convergence of the knowledge and skills required for effective application of IT solutions. The challenge, that increases with greater functionality, is to apply the ever-changing technology more creatively and appropriately, to always harness its full potential.

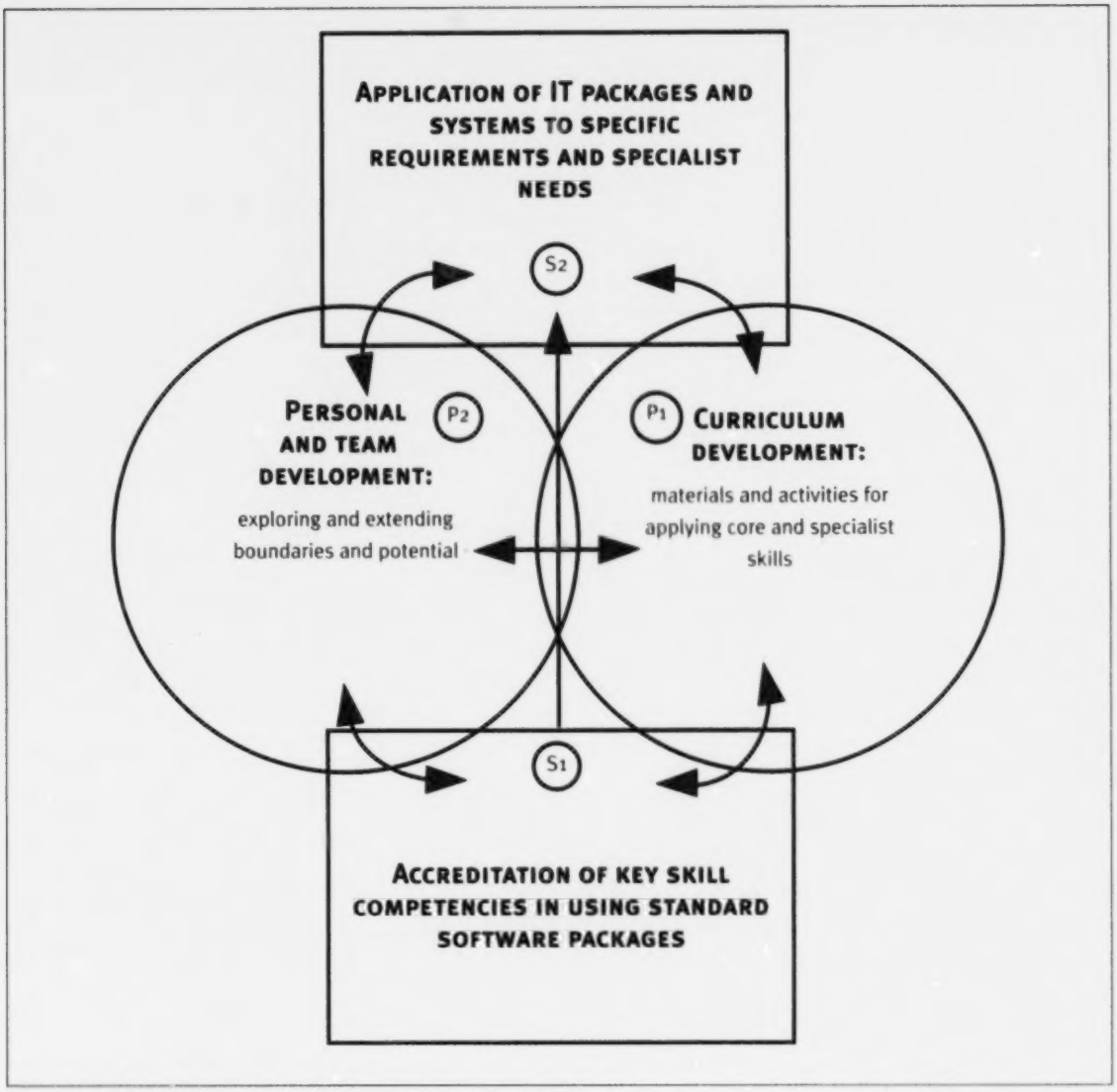
APPLICATION OF IT PACKAGES AND SYSTEMS TO SPECIFIC REQUIREMENTS AND SPECIALIST NEEDS
S2
PERSONAL AND TEAM DEVELOPMENT:
exploring and extending boundaries and potential
P2
P1
CURRICULUM DEVELOPMENT:
materials and activities for applying core and specialist skills
S1
ACCREDITATION OF KEY SKILL COMPETENCIES IN USING STANDARD SOFTWARE PACKAGES

FIGURE 20: COMPREHENSIVE DEVELOPMENT MODEL FOR IT SKILLS

Individual learning: summary

Ref	Key point	Quality indicator
5S	Progress and achievement requires tracking and recording	A system is in place for student and staff portfolios
5P	Different learners have different styles of learning	Learning materials and content are formally evaluated
5H	IT skills are constantly changing	IT key skills are accredited for both staff and students and are regularly reviewed

[S = systems-focused; P = process-orientated; H = harmonising of systems and processes]

Learning and development

1 Review, evaluate and plan the use of portfolios in your college, assigning a score for the stage of development of each aspect using the scale given in Figure 11.

2 Do the same for IT key skills development and accreditation.

Audit and evaluation points

Action planning points

6. Learning content

A consistent theme in this handbook has been that content or programmed information only forms part of the learning process. Figure 2 indicates the relationship between managing the learning process and content, as do Figures 9, 12 and 13. Learning content systems need to be designed in combination with tutor and learner support systems as shown in Figure 16 and at the end of Section 4.

The more individualised the design and development of learning programmes and the more sophisticated that applications of ILT become, the greater the need for specialist materials development and production facilities. Figure 10 suggested the following functions: programme designers, authors, editors, coders and formatters. Desk-top publishing (DTP) has been extensively used for learning material production for some time.

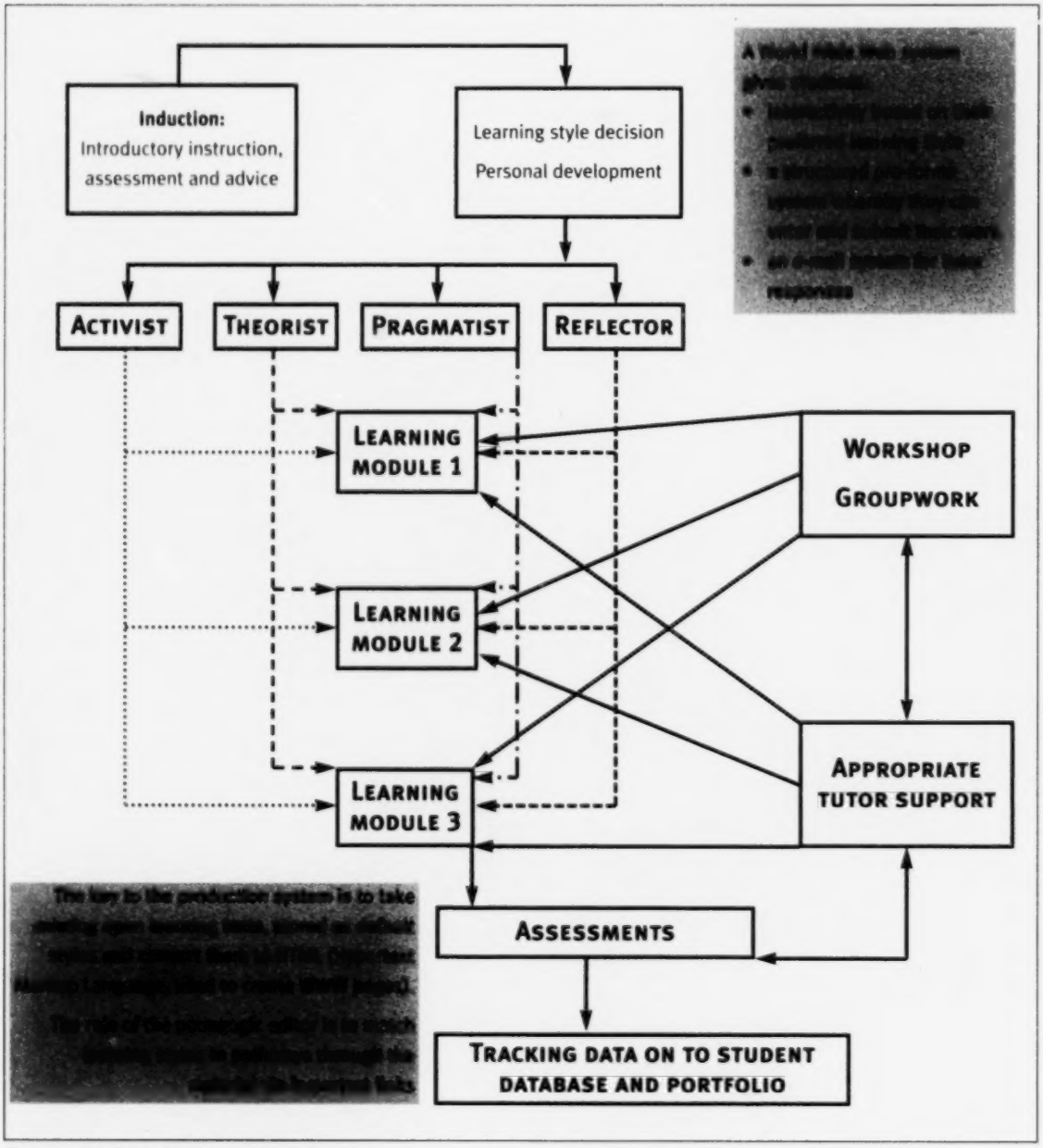

FIGURE 21: ELECTRONIC PUBLISHING

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Less widespread is the practice of combining DTP with the use of IT to bank and track materials and to set up styles and templates to customise production and presentation. However, this offers greater returns for programme designers.

The dependence of learning centres on computer-based materials will continue to grow. Tracking, management and delivery systems over local and wide area networks will be needed to cater for the full range of information forms, as shown in Figure 1. IT will increasingly provide the source of content information, through the Internet, which will be adapted and tailored to provide learning materials as is suggested in Figures 14 and 18. However, for some time to come most 'conventionally' delivered modules and programmes (whether run from within the college or from an external learning centre) will require a mixture of printed, digital and other off-line media content materials. Learning environment systems will need to be able to support, manage and present heterogeneous rather than homogeneous content.

David Wardell's model for electronic publishing, that involves the conversion of desk top published learning materials into World Wide Web format, is shown in Figure 21. It builds on Figure 17, and proposes that pedagogic editors provide hypertext links via Hypertext Markup Language (HTML — the universal language for creating World Wide Web pages) to allow learners to navigate content material in the sequence of their preferred learning style. It raises the need for pedagogic editors who understand learning styles and are competent in HTML. Many colleges may not feel adequately equipped or confident enough to provide systems for completely independent distance learning using ILT. Wardell's experience of providing distance learning materials and solutions and views on how the Internet may be applied could assist in their planning and prototyping.

Increasingly, the development of ILT will require much greater rigour in addressing the management of content. This will need to encompass how the content is:

- obtained and updated
- represented and organised
- packaged and presented
- accessed and delivered

Learning content: summary

Ref	Key point	Quality indicator
6S	Specialist learning materials development facilities are necessary	Computer-based learning materials are produced and held on a database
6P	Courseware must be of high quality	Quality standards are applied to the preparation of learning materials and content
6H	Research and development on the application of emerging technology to providing individualised and distance learning solutions is required	Intra- and/or Internet development is planned and under preparation for providing content

[S = systems-focused; P = process-orientated; H = harmonising of systems and processes]

Learning and development

1 Review, evaluate and plan the development of learning materials and content in your college, using the scoring approach used earlier from the scale given in Figure 11.

2 Suggest a set of at least three quality criteria that you would apply to learning content delivered using the Internet or an intranet.

Audit and evaluation points

Action planning points

7. Setting quality standards for ILT

A national survey of development needs (undertaken in the first phase of FEDA's QUILT programme) has revealed what college staff see as priorities. These are listed below in Figure 22.

Interestingly, these priorities are generally in reverse order to the sequence in which they have been addressed in this report. To an extent they reflect a bottom up, rather than top down perspective and prioritise an operational rather than strategic approach. In the context of a 'Development handbook' they provide a useful caution for managers when harmonising top down and bottom up approaches to ILT development in the context of Figure 6.

Priority	Goal/Need
1	Provide IT awareness and basic skills training to all students
2	Provide IT awareness and basic skills training to all staff
3	Increase the effectiveness of teaching/learning through the use of IT and a range of flexible learning strategies
4	Achieve a fully integrated cross-college IT network
5	Provide more flexible learning opportunities throughout the curriculum by making greater use of resource-based learning materials and facilities
6	Expand the range of facilities and/or number of student places in flexible learning centres and/or libraries
7	Expand and upgrade all computer hardware and software facilities throughout the college
8	Provide effective computerised tracking systems
9	Integrate the use of learning technology in mainstream courses
10	Co-ordinate all IT-related planning throughout the college

FIGURE 22

The section entitled 'Quality and planning' drew attention to the importance of developing quality standards, which can be used to provide performance indicators. The key recommendation of this handbook is that each institution draw up a set of quality standards for planning the development and evaluation of its IT strategy. Each standard can be used, as indicated in the flowchart in Figure 8, to evaluate the college's position with respect to ILT and establish where it plans to be at fixed point in the future.

Attention should be given to the standards which address:

- systems (S)
- processes (P)
- harmonisation of systems and of processes (H)

The following groupings for standards are proposed, which are based on the sections of this report and are reflected in Figure 2:

- External change (learning from history)
- Organisational change (learning and the management of change)
- Organisational management of ILT
- Learning environments or learning centres
- Individual learning
- Learning content

For each group a key point and quality indicator, classified as system-focused, process-orientated or harmonising of systems and processes, has been identified in the summaries to provide a basis for deriving quality standards. A quality indicator is intended to provide pointers towards a quality standard. These are organised into the groupings proposed above (see over).

The points, indicators and their classification are by their nature general guides, intended to promote discussion and evaluation. They are suggestions and should not be taken as

absolutes. They should be used as a basis for auditing, evaluating and planning college ILT development. They provide a checklist to:

- assess the current stage of ILT development in the college
- plan and measure the progress of ILT development
- raise the awareness of staff, partners and sponsors of the college to the issues raised by and involved with the development of ILT
- assist in the identification and prioritisation of objectives in the context of investment and resource allocation

The audit and planning should be carried out via a team-based approach. This should emanate from the senior management team of the college which may decide to allocate different aspects of this categorised set of standards to different specialist teams, such as the staff development team, resource-based learning team and quality team. An alternative, that can be combined with this approach, is to engage departmental and curriculum teams in the same process. In the absence of senior management commitment a 'bottom up' approach can be adopted by concerned functional or curriculum teams to inform and influence senior management.

The following activities (which are consistent with the model shown in Figure 8) need to be undertaken to achieve the audit and planning:

- consider each key point and quality indicator and determine if it is appropriate to be used or needs modifying or omitting

Key points:

Grouping/Category	System Key Point — S	Process Key Point — P	Harmony Key Point — H
1 **External change**	Information impacts on learning and management	Rate of change — reducing cost, increasing capability	Convergence, connections and communications
2 **Organisational change**	The quality cycle provides a basis for development and and for harmonising systems and processes	A culture of learning and teamwork is required	New technology requires the transformation of the college
3 **Organisational management of ILT**	A planned institutional infrastructure is required	Flexible human resource practices are needed	Learning and management systems must be integrated
4 **Learning centres**	ILT must be an integral part of learning centre development	Tutors need to provide the necessary support to allow students to develop a questioning approach to learning	Programmes of content of need to be organised into 'chunks' or modules
5 **Individual learning**	Progress and achievement requires tracking and recording	Different learners have different styles of learning	IT skills are constantly changing
6 **Learning content**	Specialist learning materials development facilities are necessary	Courseware must be of high quality	Research and development on the application of emerging technology to providing individualised and distance learning solutions is required

- identify any other relevant key points and determine a quality indicator for each one
- design an audit and action planning form (such as the format used in Part 2 of *Flexible Colleges* [FEU, 1991], which is a planning handbook)
- use the quality indicators to generate audit questions — the indicators themselves may be used for this purpose
- determine what items of evidence can be used for each audit question and whether to use a scoring system (such as that suggested in the summary for Section 4)
- undertake the audit, which may be shared between team members
- evaluate the audit results as a team activity, which may involve scoring as suggested above
- action plan on the basis of the evaluation, identifying resource requirements, responsibilities and time-scales
- determine who will review the plan, how it will be presented and how frequently this will be undertaken

Adopting a structured system for team-based auditing and for planning of ILT implementation and development will provide a rich learning experience for the team. It will also directly contribute to the college becoming a 'learning organisation'.

Quality indicators:

Grouping/Category	System Indicator — S	Process Indicator — P	Harmony Indicator — Q
1 **External change**	Comprehensive information strategy is in place	System exists for 'scanning' developments and for evaluation and open communication	Integrated communications and computing strategy is in place
2 **Organisational change**	Quality standards are agreed and applied in audit, review and planning across the college	Listening and the sharing of ignorance as well as knowledge is positively encouraged	The college has identified its current level in the 'transformation model' and is addressing the impact of ILT on transformation
3 **Organisational management of ILT**	Industry standards are reviewed and applied	Staff roles have been developed to support the infrastructure and applications development	Computerised tracking systems are being developed and applied for student progress and/or learning materials
4 **Learning centres**	Learning centres have linked and co-ordinated computer networks	A tutorial system is integrated with learning centre provision	A strategy is in place for curriculum unitisation and/or modularisation
5 **Individual learning**	A system is in place for student and staff portfolios	Learning materials and content are formally evaluated	IT key skills are accredited for both staff and students and are regularly reviewed
6 **Learning content**	Computer-based learning materials are produced and held on a database	Quality standards are applied to the preparation of learning materials and content	Intra- and/or Internet development is planned and under preparation for providing content

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